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# Dissertation on Physical Examination of the Organ of Sight

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Dissertation on physical examination of the organ of sight and the skin system which shall be publicly defended on 22 December 1823

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## I. On physiological practise

### Introduction

As for me, considering the range of obligations of a medical practitioner, the following conclusions appear to be of particular significance. Not only is he concerned about restoring of what is actually weakened — or at the very least sustaining for yet awhile the fragile life — but also his mission is to support and protect against all odds what is a well-developed, well-maintained, well-preserved life of a human being. Thus, his attempt is not only to diminish the very possibility of illness. More to that, he labours to guide human life towards impressive perfection and admirable beauty, which is an evidence of life being a heavenly phenomenon.

Taking into consideration the fact that this is (or at least should be) the actual role of a doctor, it seems perfectly justified then to call him an artist rather than a craftsman. In such a case, he is worthy indeed to be compared to Phidias, who created Apollo and Juno. However, what should be borne in mind is that the work of a craftsman does require no less effort and inspiration than that of an artist.

Such a high status of doctors should be based on their more eminent role, and physiocrats delineate the actual boundaries of humanity according to this concept. Moreover, by no account should yet another fact be offhandedly dismissed. Namely that the institutions of the ancient peoples — Egyptians, Persians and Indians among others — where the highly-respected class of doctors (called either high priests, or magi, or else Brahmins) was given the primary position in running the country. Yet, I do not stand in for that misusing which either has become deeply entrenched by a long prevailing custom or, perhaps, has been brought by a devilish spirit.

Well-known is also another, very positive aspect of the doctor's profession. Not surprisingly, during therapy a doctor discovers the threads of life according to the laws of nature. That makes it then possible to him to treat such a disposed organism accordingly to its needs depending on various periods and conditions. All that results in turn in guiding the human being into such a state of body and spirit in which a most perfect equilibrium is achieved and preserved — the same harmony which echoes the very spirit of platonic philosophy.

An old truth is that medicine has been widely considered as a branch of art since the ancient times. There is virtually no day that we could not see most incredible patterns of plants which an experienced grower to such a great shape brought into being or examples of animals which a qualified breeder — using the "laws of medical art" — raised in a spectacular manner. Yet, should one attempt to apply such efforts to the human organism, considering them either possible or suitable, it clearly shows its paradoxical nature. The only aim of shaping

human body and should always and with no exception lead to achieving real freedom.

There is, after all, nothing controversial in the claim that a doctor always tries to diminish the amount of suffering and pain written into the human condition. Nor it is any surprise that this is his most important obligation to which he was committed due to human weaknesses or inappropriate lifestyle even since the very young age. Little do we realize that the core of medicine actually lies somewhere else. The main aim of the art of medicine is in fact preventing rather than curing illnesses. To make a weak organism strong, to stop diseases from spreading, to protect the human body from harmful impacts of environmental factors. Finally, to combine all these in such a manner as to make human life, in all its periods and for all of the people in the world, healthy, strong and flourishing as much as possible, until the natural end. That is not to be left to mere coincidence or neglected. Nor should the previously mentioned obligation of doctors put a shadow on this primary aim of the medical art.

Fortunately, day after day and year after year, the awareness in this respect is growing. The rulers of many countries begin to recognize the significance of preserving and promoting physical health of all members of their communities. Thus, it seems natural to conclude that medicine ought to be subjected to common law. The physical state of perfection of each and every member is indeed of central interest to the executive power. However, efforts are undertaken in too disperse a manner to bring about an immediate and desired result. For all too long those attempts are ventured to no avail.

This role of medicine I decided to name physiological practise. I believe not to find any opponents to my claim that this practise should be recognized as an axis around which the most basic interest is to be found. Physiology, being a field of knowledge focusing on the very idea of human life, its common manifestation through individuals and life periods, finally on their relations to the external world and inherent adaptation, is indeed concerned with ensuring that the idea of human life develops free from distractions of external factors and time as such. That should be rightly called physiological practise. A field which comprises hygiene, medical clarity, physical education, dietetics as well as gymnastics and physical effort — all most desirable for human health and sense of well-being.

## II. On exploring an individual organism, in general

As far as the tasks of practising doctors are concerned, they normally deal with sick people, therefore a great part of doctors' role consists in protecting human health, in other words preventive care. That is why in the past kings and rich landlords had their own doctors, who were always at their service, to provide advice and help them retain good health. Exploring the life characteristics observed both in good health condition and in sickness, the doctors were able to work out effective methods of treatment in case of illness. It is often said that it is better to trust the doctor on whom we relied for years, as such a doctor, having treated us in the past, had the occasion to thoroughly learn our life characteristics or, as some say, our nature. I am convinced that this common opinion is quite to the point. It is not enough to get to know the disease — the doctor must also get to know the individual overtaken by the disease. Practicing physicians from different epochs held the view that illness diagnosis is of paramount importance to the practical application of medicine, because a specific form of illness is not only an abstract and common phenomenon, but it is really connected with the individual it dwells in. Therefore, it has always been crucial to explore specific characteristics of individuals, as the severity, symptoms as well as the course and ending of an illness greatly depend on them — the individual characteristics are as if in a central place, one can compare them to the rays of light, which become refracted and fill up with extraordinary colours. This is why it is essential that the methods of treating a disease and applying medications be adjusted to the individual needs of the patient.

Nowadays this practice is called the art of individualisation (die Kunst des Individualisirens). In this art lies the greatest success of medical practice, and the doctor's ability to help the patient depends on it. It is so because, owing to doctors' unique sense or intuition, the art has become fixed, and not even as a common scientific asset, but as the ability of individual people — either given by nature or acquired through own efforts.

The foundations of the art of individualisation were laid by physiology. Physiology is a science concerned with exploring the special nature of the characteristics of a given individual, the health condition normal to him, the ability to absorb, in a specific manner, external forces, and reacting to them, a set of individual characteristics, temperament, sex, age, genetic conditioning related to one's ethnicity or family, influences coming from climate, society, customs, work and other factors.

It is not enough to obtain a general picture through reading specialist literature or through superficial observation — one must seek, thoroughly explore and judge symptoms present in particular individuals, so that the individual's nature could be brought to light. And if an individual is a being whose all characteristics can be determined, the process of learning them requires more

acute observation than in the case of developing general scientific theses.

And if one observes the surrounding world with a trained eye, every being seems capable of being fully characterised and interconnected with a myriad of characteristics. Moreover, in the order of organisms of every kind, the specific connection with the external world appears a closed circle, the contour of which shows differences between particular species. Indeed the differentiation among particular beings has not occurred by chance or has not been caused by accidental impact of external factors, yet one should assume that there is a certain standard and external model, which always recurs and brings a certain rule — within the limits of each species — to the changeable nature of organic bodies, and the explanation of which paves the way to the deepest imaginable cognition of the nature of an individual being.

This phenomenon of changeability is most developed in the human species, and had the science of physiognomy not been drawn away from the right path in its very beginnings, as a result of biased opinions and immature assumptions, now we would possess at least the framework of the natural doctrine of human physiology, with individual characteristics of the human external shape, split by classes, according to types and species, supplied with descriptions, explanations and adequate images. Similarly with the cognition of the specific influence of external forces — be it elements, minerals or organic substances — in a living being, which reveal the characteristics and fundamental principle of an individual's ability to absorb external factors and react to them — in other words individual constitution. This too is in its infancy phase presently.

However, to make the art of individualisation actually work, it must be applied so that an individual is examined in close connection with external factors, as it is required to explore the specific nature of an individual being and its relationship with other things. A similar problem is to be solved by the art when, having learned the mental nature of each individual, all external factors are adjusted so that the natural capabilities of an individual being are developed, his strengths are trained and the effect is harmony of actions and relations, which shapes the life of the individual the most.

### III. On physiological examination

Physiological practice can be considered in relation to the therapy standard which is free from diagnosis, prediction, indication and treatment. Diagnosis is based on examination which, both with regard to the present and past condition, if determined thoroughly, prepares the grounds for appropriate determination of other tasks to be completed as part of the practice.

As far as pathological examination is concerned, in which very thorough analysis allows one to learn the nature of every disease, there are numerous medical principles, models and dogmas to be found. This is not the case with physiological examination, which turns out to be no less necessary than pathological examination.

Examining the life condition and functions as well as the shaping of an individual organism, one acquires empirical cognition, which — reduced to higher principles of science — establishes an individual physiology.

Since in acquiring physiological cognition the analytical method is used the most frequently, the existing empirical assumptions are reduced to more general ideas, reaching the highest principles of science; on the other hand, it is equally important, starting from the universal ideas when examining a specific subject, where all sensual imaginings and ideas are as if focused thanks to scientific methods of experiencing and understanding, the area of observation can be determined. Thus, in the individual subject the whole scientific system is set for observation and science is as if equipped with a body, while the subject of experience is as if dead and soulless and only the light of science brings him to life.

However, what is most crucial in each practice — even if the theory of things is completely understood — is to work so that the acquired knowledge could always be at our disposal, so that we are able to recognise with our sharp minds, even in unstructured and rough mass of concrete things, the general principles of science, which inwardly we perceive as free from empirical constraints. In this way science becomes a living tool, not — as happens more often than not — when it rests as if in the embryonic phase, but when it reaches outward, subordinating the external factors and takes the entire world under its control.

If any of the doctrines has such power, it is without a doubt physiology, whose subject of observation and action I think cannot be either something direct or something more remote.

Therefore, this application of the general physiological doctrine in empirical cognition of organisms should, in my opinion, be called physiology.

The famous work by Kieser (Entf. d. Medizin, p. 624) touches upon many interesting issues relating to pathology. Since pathology as a science is based on physiology, it can be applied for our purposes. What I mean here is that the prototype of universal life in any sphere of organisms, wider or narrower, in every organic system, and even in particular entities takes a specific form; therefore also the common principles of life are modified in par-

ticular organic entities that neither numerous entities nor the same entity over time can be equalised — considering external or internal factors. The truth of that claim was recognised already by ancient doctors when they commented on idiosyncrasy, sympathy and antipathy between various individuals.

However, in this field it is not enough to get to know the obvious and exceptions to it, but one must capture in every entity, and even in every organ, idiosyncrasy, nature and specific shape, which, combined, form individual physiology.

In this effort, the key role is that of physiological examination.

Specific forms that show in a given organism should be observed as well as actions manifested through the living process or caused by the natural or artificially created influence of external factors.

Thus, experience is needed where mere observation is not enough, and in the case of weak bodies special precautions should be taken or highest sacrifice made when we subject ourselves to danger.

Now, if I attempted to present in greater detail the matter of physical examination, I should discuss it in the context therapy, medical order, forensics, obstetrics, education, everyday life for the purpose of determining work standards and life tasks, and finally the application of plastic arts; one should follow methods thanks to which in the individual examination of a given organism empirical data according to the anatomic order are sought or physiological terms, modified in a specific case are followed, where, in the fashion of educators — progress is made from the simple phenomena to complex ones, or transition from visible phenomena to more hidden ones; notes should be taken on conducting, in an appropriate and cautious manner, experiments live; finally particular phenomena requiring a closer look should be specified — the origin, nationality, regarding family and the given individual, sex, age, general constitution, temperament, idiosyncrasy.

Apart from that, diathesis, either genetic or developed, relative health, particularly acute symptoms, the therapeutic nature in illnesses or the consequences of routine activities, diet, life condition in the organism should not be ignored. First of all the general life functions should be analysed as well as reproduction, irritability, sensibility, whose characteristics are shown either in a plastic form or in the manner or organic and spontaneous movements, felt in the subjective sphere of sensation. Last but not least, the natural and artificially created relationship between the external world and the individual should be taken into account — physical, chemical, organic and mental — organised cognition of which, through observation and experience, constitutes — as far as it is permitted — physiological aetiology.

Although neither the aim or the place require it, I shall elaborate at least on some of the parts of the proposed work.

On the following pages I shall distinguish the basic factors which appear in physiological examination of the organ of sight and the skin system, some of which are new, but they should nevertheless not be disregarded by the reader.

## IV. External physiological examination of the organ of sight

1. The first thing that usually shows during such examination is myopia or presbyopia of the examined subject. To analyse more thoroughly these conditions in a scientific examination, the most appropriate instrument seems to be the apparatus promoted by Tauber, an optician from Leipzig, or a similar one. Having set the bar horizontally and having divided the scale into lines, and even smaller sections, and having set the fuses on immovable surface, whose length should be 30–40 fingers, the person conducting the examination should direct vertically the pulpit, equipped with clasps, to which plates or sheets with symbols could be attached, so that it could be slowly moved horizontally by the bar — forward and backward, and accordingly the scale could be measured up to the smallest units it is divided into. An apparatus with an appropriate opening should be placed in the front end of the bar, to which the looking eye, or even the entire head of the person looking should be attached. Glasses should be placed along with the horizontal bar in the support, which will be gradually lifted or lowered, and it can be stopped at each height, by pressing the reel, according to the size of the person looking, position of their body, whether standing or sitting. As the upmost accurateness is required so that the distance between the eye and the object seen on the table could be expressed with lower numbers, it will be necessary to apply at the side of the eye a horizontally moved plate with an opening, through which the outline of the cornea could be seen, and according to it the beginning of the seeing distance could be accurately determined. In addition, a few tables marked with points and lines of different sizes should be available, measured with a micrometer, white against a black background, or, for other purposes, sketched with other colours. There should be a pen near the pulpit, which will be needed for presentation of data. Thanks to such instrument, presbyopia or myopia could be diagnosed with the highest detail, and at the same time findings could be made as to the method in which the shapes of points and lines change, or when

they are moved away from the seeing distance or moved too close to the eye. If an object does not require so much diminution, as usually is the case in everyday life, a paper marked with handwritten or printed signs, placed on the pulpit and shown to the examined subject to read, should be enough to notice sharpness or weakness of vision.

2. The same apparatus will be appropriate for determining the distance of varied seeing, that is the size of the part of the seeing axis where objects that are moved closer or farther away are seen with the same sharpness of vision, and according to it the ability of the eye is determined which enables such arrangement of the internal juncture and optical mechanism that rays coming into the iris create focus of objects — either remote or own — in the retina itself.

3. It usually happens in case of shining objects, if they are far from the varied vision, that more or less numerous additions or even doubled or multiplied images are shown, and this phenomenon has been experienced by almost everyone gazing at candlelight at night. This diffraction of light undoubtedly depends on the bending strength of the cornea, which can significantly differ, as well as other eye elements, and in some individuals this manifests as an illness, when every shining or glowing object, divided here and there, appears to them to be hair or beard. The aforementioned apparatus allows good observation of this condition, when, instead of tables, a metal plate pierced with points and lines, and even transparent, is placed on the pulpit, at the back of which a wide flame flares up on the interlaced candle wick, lightening these points and lines. One should be cautious to close the flame properly, to prevent light coming to the eye from other side than the perforations and gaps; thus, when moving the blades with the lamp closer or farther away, distraction of light is shown, its direction, and, depending on the distance, amplitude will be shown, through which the type of irregularity of the cornea or refraction of other elements can be determined.

4. The same apparatus, if appropriate measures were applied to obtain various and measured degrees of darkness or dawning, or full light, and if certain objects were provided and properly arranged, it could be used for various photometric experiences, through which, either the lighting up of a given object — for example the sky, the moon or stars — or various glowing bodies could be determined, or the degree of the eye sensitivity to light.

5. Similarly, the eye sensitivity to the specific quality of each colour, to different distances and at different lighting angles could be examined; as it is known that the colour quality in objects that are sufficiently diminished disappears at particular distances, and coloured surfaces, when light gradually fades, changes to grey or brown, and finally to a very dark colour.

6. To determine the eye ability which causes movement to look at or through objects, the strength with which the eye is fixed to the observed objects and the confidence and quickness with which it moves from one object to another, a scarcely visible point is marked against a black background (or the other way round), observing which the eye is simultaneously fixed up to the second minute from the beginning of looking, until the image becomes blurred or the eye tires and is not any longer able to remain fixed at the given point. As the strength of the free eye, moving according to the will of the individual, must be assessed, a series of tiny points must be shown to the examined individual, the distance between the points must be very short, set on straight or curving lines, and the number of points must be earlier known, and if the eye is able to count these points, in the shortest measurable time, with no delay or repetition, and without a slightest error, its valour can clearly be seen. In this experience the eye should be closely observed, and its stability, if its fixed, or sharpness, if its moved, will be established based on the number of points calculated.

7. A given point is placed on the axis line where vision is clearer than in the case of the other points. Since the eye axis runs vertically to this point, it is said that the point is seen in a straight vision; the other points which are placed in the field outside the axis line are visible only from sides, and therefore such vision is called diagonal. Straight vision has its range, outlined with lines drawn around it by objects, when the eye moves in its orbit. The more forward the eye reaches and the greater the ability to move the eye in all directions, so that the cone marking the axis forms the largest base with the least — as far as possible — obtuse angle of the top which is placed in the eye, the larger the range of direct vision. To facilitate the observation of the amplitude of direct seeing, a section must be formed with three fourths of a circle, with degrees marked, from the centre of which the eye will notice — with the head unmoved — an image well seen in the outline as moving, which can be said to be clearly visible as long as it reaches the border of the movement of the eyeball, where the image should stop at the outline and be marked in the triangle degrees, this image was reached by the eye, which was moved on the sides.

The other movement direction, where the section from the horizontal position around the axis will be

moved towards the others, should be empirically analysed in the same manner.

8. The area of diagonal vision is outlined with space which, if the eye was fixed at one point, would seen, yet less clearly, in the other seeing area. To determine the size of the area of diagonal vision, the same apparatus as previously can be used, having added only the image from that part of the eye that looks as fixed, whereas the other, well lightened, is moved from the side forward and backward.

9. The same circle can be applied to determine the calculation between the point through which the axis goes in the retina and the place where an optical nerve goes into it. In this particular place in the retina, the picture which is more or less clearly visible in all other places, disappears completely. Therefore, first having fixed the eye axis in the image placed directly opposite to it, which can be appropriately lifted or lowered, a side line in the horizontal line, moved here and there until it disappears, and this marked placed and lifted to the axis point in the retina, drawing simulated lines through crystal lenses, the place of entering of the eye nerve is established, which can differ among individuals with respect to the horizontal and vertical exit from the vision focus.

10. To determine the convexity of the cornea and the front surface of the eyeball with a greater detail, a clear linear cavity, well measured from the right distance observed by a well fixed eye and bent should be examined with a microscope in a horizontal position with the use of a micrometer. The smaller the linear image appears, the shorter will the ray of the spherical section will be, which is formed by the front surface of the cornea or sclera. To make the calculation between the length of the small bent line and the diameter of the sphere certain, a series of measurements for easy determination of comparisons should be available before one starts conducting experiences in a series of spherical sections made of glass whose diameter could be accurately measured thanks to the microscope. Here I should mention the method with which E. Home determined cornea modifications, when seen up close and from a distance, measuring it with a microscope attached to the eye from a side.

11. The convexity of the eyeball from the orbit falls to the eye either by itself or is examined with touch, by putting fingers to the edge of the orbit and to the cheek, so that the top of the eyeball covered with the eyelid is touched simultaneously. Frequent exercise, examining various eyes, will allow one to draw conclusions as to the their convexity or retraction.

Another criterion of convexity or retraction of the eyeball relates to the eyelid, which — opened completely, opened partially or closed complied — as they are closely attached to the front surface of the eyeball, also perfectly reflect its shape, especially when examined from a side, along the face profile, where the distance between the eyelid and the most external line of the nose base, and its placement by the supraorbital ridge provides most details.

12. The size and shape of the cartilage of the upper eyelid can be assessed based on that part of the eyelid which, when slowly closing the eye, is situated between the edge and the upper fold, since the cartilage is more pronounced here, with external layers. The eyelid which is formed from the brow ridge when skin falls and folds back, when it changes into such a fold that is more loosely attached to the cartilage, it forms very different lines in various individuals, and is a vital factor for painters who intend to capture the characteristic features of one's eye.

13. The organic status of the conjunctiva and in particular its capillaries can be observed with a simple lens, where one can see, especially when the eye is inflamed, a strange arrangement of capillaries.

In more delicate subjects, especially after night's sleep, a slightly protruding line running from the eye corners to the cornea, caused through pressure of the eyelid edges, can be seen.

14. Data concerning the conjunctiva's vulnerability is to be compared over time; the open eye may resist the flowing air, in result strengthening its capabilities. What is to be remembered at this point is that one has to pay close attention not only to the actual chemical nature of the air, but also its temperature, so as to make it seen what effects would cold and warm air have in the very same subject.

Wherever the vulnerability is lesser, influence of the air is to be enhanced by blowing. In such a way it is often the case that not only the very vulnerability is overcome, but also that has a real effect on guiding the body by the mind, rather than vice versa.

15. That guiding of the body by the mind is even more clearly visible when an open eye is suddenly being approached by a finger — if the eye shows no reaction, it is called strong and appropriately obedient to the person's spirit. However hilarious a method that may appear

to be, used by little children only, by no means should a physiologist neglect any diagnostic factors.

16. How abundant in fluids the eye really is, may also be measured by applying various external tests causing intentional irritations. Among the best means of doing so we differentiate the following: fluid ammoniac, ammonium carbonate or very mild sugar powder being blown into the eye. How the gland cooperates with the cardiac plexus is to be observed only through observation rather than experimental studies.

17. Lacrimal points tend to draw into a free eye by themselves. Regardless of whether they are open or shrunken, they are best examined by blowing air into the eye when both the nose and mouth are closed. Thus, since there is no other entrance, the air is flowing freely through the lacrimal duct and lacrimal points with mild whiz, causing a slight and delicate sensation.

18. The flashing membrane is, on the other hand, best spotted when the eye is turned — as far as possible — to an external angle. Then the eyelids should be slowly and in a very delicate manner pushed aside.

19. Lacrimal meat and lacrimal lake, tarsal glands and their ekstomoses, the internal part of the eyelids, eyelashes, their length, arrangement and number, the placement and shape of the eyebrows — all these draw themselves to the eye. Also, the properties of the external skin covering the eye and its immediate surroundings, its softness, tension and wrinkles, colour, shaping of pores in the periosteum of the orbit, folds of the eyelids and that kind of wrinkles which become visible in the angles of the eye when it is being squinted, as well as those which can be spotted on cheeks and at the base of the nose — all of the aforementioned features under no circumstances are to be neglected during examination. The reason why it should be so is that they may contain relevant information as to physiognomic features or the actual structure of the under-skin muscles.

20. Thickness and transparency of the cornea is probably best observed when candle light is held close to the eye in a diagonal direction. The image of the flame is then reflected from both perspectives at the same time (Fig. 1), making the cornea more visible. Consecutively, the person that examines the eye should watch the angle of the cornea more closely, which can appear more blurred or well visible. Taking into account all possible results of such observation is of primary significance, especially in the semiotics of periods distinguished in human life.

21. Finally, the sclera resembles a fibrous membrane — thus by examining its properties a doctor is able to draw conclusions regarding the condition of the entire system of fibres in the organism as a whole, according to the pathological and physiological peculiarities of the individual.

In children its whiteness may shade into mild azure due to a transparent choroid characteristic to the young age. In adults, however, as a result of the work of blood vessels it becomes more muddy in colour. Whereas yet for some people it remains too shining and seems more chalky. To top it all, various human races differ in respect of the lasting colouring. The sclera's transparency may be best observed with a candle flame falling in such a way that it is slightly oblique relative to the eyeball. Then it comes through the cornea and watery liquid up to the very angle of cornea on its internal side Now, farther through the internal substance of the sclera and the front side of the iris — it forms deflection in the shape of a lighting cone whose base is on the cornea and its edge stretches up to the angle (Fig. 5). When the varicose veins of the eye are beginning to develop (especially common part for that to occur is the choroid) then also cyanosis, either partial or total, embraces the sclera. That is the case when its membrane becomes weakened or the venous blood somehow manages to get into its internal substance. Moreover, also different kinds, degrees and spots of redness in various inflammation forms can be frequently encountered. In the case of the highest, worst kind of xerophthalmia, the sclera altogether with the cornea start to look like a callous epidermis.

22. As far as the watery liquid is concerned, the examination causes considerable difficulties. Theoretically speaking, the amount of liquid may be judged by the convexity and hardness of the cornea. However, what makes this matter more complicated is the fact that the actual convexity and hardness of the cornea are rather problematic to be examined precisely enough. Clarity of the cornea, when the eye's condition approaches a pathological state, mixes up with clarity of the watery liquid making it virtually impossible to be easily spotted under an oblique angle. Even if we are forced to diminish the degree owing to an insufficient amount of the liquid, our sight still is not able to comprehend a fair picture. The only thing to be done then is to use a suitable microscope. By such a means, the light from the internal part of the eye, distorted either by the lens or else by the iris, can be perceived in a manner similar to that of a mirror which in a microscope is put under the subject of examination. That in turn would finally enable the doctor to accurately examine the relevant liquid. One thing must be kept in

mind during this procedure however, namely that every single optic device must be put to the examined eye in the most appropriate and accurate manner. In the subjective sphere of vision, the mixture of the watery liquid is presented by means of colourful edges of the candle's light. This makes it difficult to discover more precisely various degrees of the mixture. Why is that so is that comparing the internal feelings in many, many individuals is often not something reliably established. However, I believe it proven that if some small cells, fibres or globules are subjectively thought of as perceived, it is not possible that they are placed before the lens. The reason for that is that the image coming into through the rays under an oblique angle, is then being destroyed completely in the retina. With one exception, though, that being the case when size largely overcomes the weakness of the external light. That in turn would help to shape a distinctive shade within a nerve itself. Then little spots in the images of the external light are easily noticed. Their character and substance however are not equally easy to be measured or described due to the obstacles in the cornea, lens and glassy liquid — all of them being capable of causing a similar kind of perception.

23. The external examination of the iris rather fairly suggests ample diversity of colours and its fibrous binder. Apart from the others, three circles especially distinctive in colour and structure are worth to be mentioned at this point. Of them, the most external ones are usually darker and marked by a few fibres and creases going parallel to the edge. The one in the middle ones are slightly brighter, with fibres and creases radiating. Whereas the internal ones more shady again, with a significantly greater deal of fibres and creases going into the middle of the pupil. In some individuals, those are shaped in resemblance of a funnel or a crater. Cracks, openings and creases of the iris are best examined when lightened by a possibly weak candlelight in a side view. Slow motions of the light make the areas shaded and lightened in such a way that fairly clearly a picture of valleys and elevations can be seen. Then this part of the iris which is shaped as a funnel (which, as has been said, is even more conspicuous in certain individuals) becomes very easily noticeable.

What also should be examined are the different sizes of the iris membranes between the pupil and its external edge. At that place where the heart of the pupil is shown as either pressed or distracted, or the iris' external edge together with the cornea edge, departs from the regular shape of a circle (usually when its upper part has become slightly pressed). The eye's iris is best examined when, having put the candlelight under an oblique angle, we put the lens whose focal distance is half a thumb in such a way that the internal part of the iris is most conspicuously lightened. That also enables the doctor to observe the slightest fibres and creases which are being shown in a substituted mirror. The examination will be even more precise if we use a microscope whose lightening lens is appropriately set and keeps the eye in the right position, as if it belonged to some other person.

24. The irritability of the iris as well as the degree of its shrinking capability may be examined in a number of ways. Among them the following should be enumerated: shifting from light to shade and back to light; covering one eye, looking at either what is closer or else what is remote, finally a range of various drugs may be applied if necessary. Thus, resorting to the help of certain drugs as extraction from the *atropa belladonna* or *hyoscyamus*, the pupil is caused to extend or shrink. Also other attempts to define the effects of drugs to the iris have already been successfully made. However, how much of the drug is precisely needed to stop the inflammation of the eye-ball is yet to be investigated. Various solutions mixed to different degrees should be applied in amounts accurately defined for different individuals — so that the actual relationship between the organ's inflammation and application of stronger measures could be discovered. Thus, observing the iris in older people as well as those who suffer from short sighting is of primary importance. The reason for that is that looking at remote objects as well as those near to the patient is an effect of the iris's extending and shrinking. Indeed, a great discrepancy in the look of the iris is observed among individuals (determining factors are also their age and sex). That makes it virtually impossible to precisely investigate all of the possible forms and examine them medically. Such a venture, however, would be courageous and indeed admirable.

25. The external examination of the eye's choroid is possible only with immense difficulties. In the case of children, however, who have very delicate and steady cyanosis, the choroid may be observed through the sclera. Whereas adults, whose cyanosis is not so steady, have varicose veins. In the subjective sphere of vision the shaping of the choroid, as I firmly hold it, is shown thanks to the ramification of the pulsing veins, which after a rapid movement of the body or pressing of the eye, becomes easily visible. Moreover, I believe we should include here also these black spots which we often perceive in summer, as a result of greater activity requiring significant effort (for example, climbing stairs). I have reasons to think that these spots are the effect of the veins of the choroid pressing the nerve's membrane.

26. The condition of the pigment, its colour or insignificant degree of clarity, for the subjective perception of different individuals, would often present itself in dark colours.

How great importance holds the colour of the pigment for the bright and shaded part of the image in the retina. Per analogy it seems justified to compare it to a dark room where certain colours are perceived as if they were different, resulting in a very inaccurate picture. The external colours may be either pushed outside (like it is the case with, for example, red by green); or they weaken and shade, or yet else, become more conspicuous with those parts which are deprived of the colour acquire the one being in retreat. Despite the fact that these are regular, physical aspects, I do not hesitate to apply them to account for the modifications of the perception. I have no doubts that the image which in the basis of the retina is saturated with a particular colour also appears to be as such to the soul looking at it.

My explanation would go along this line: when the pigment shades, also the whole image of the plasterer shades as well. Again, it seems to me almost certain that an appropriate anatomical examination would only confirm my view — that this phenomenon of perception which used to be called acyanoblephsia does depend on the colour of the pigment.

To that I also refer the blackness of the ink. It is when we find ourselves in a position in front to the sun which is going down, and then with half-closed eyes return to reading, when the rays go through the skin and the eye's membrane causing the retina and the pigment to perceive a red colour.

I do not consider it to be absurd that the blackness found in different individuals — in their blue, grey and black eyes — also appears to be not of the same shade. However, the subjective view is never to be taken as a reliable, objective measure allowing for making comparisons. It may well be that in a similar manner to the existence of a 'cianometer' (which serves to examine the blue colour), there also should be invented another device 'melanometer' to investigate more precisely the various shades of black found in people's eyes.

27. The capsule of the lens is so extremely delicate and linked with the lens itself in such a manner that — unless that is a condition of some disorder or illness — its external area is fairly easily distinguished from the very lens. That shall be our subject of investigation on the following pages. In order to do so, then, their external area should be first discussed. If we put candlelight in the distance of about six fingers far from the eye of a given individual, in such a way that the flame observable in the cornea is placed on an accurate angle between the pupil and the edge of it; then in the pupil we may see not only that flame but also another reflex of it, smaller and distorted, shrinking as if in retreat. This little flame through the back part of the lens may be quite easily spotted, having a compartment in a glassy lens. (see Fig. 2)

The front area of the lens, as well as its internal structure to some extent — unless it is bright enough — we put in a position to make observations, if we put the candlelight, watching under an oblique angle, to the opposite side of the eye in such a way that the lines from the observing eye and the candlelight lead to make yet a smaller angle — then the vertical image of the flame will be well presented. Being in such a vertical position, this image appears, through the upper part of the lens, to be as if angled (FIG. 3). If then the substance of the lens is somehow mixed, then the image of the flame being recreated internally by this angle radiates and is encompassed by the fleeing weak light on both sides.

I believe that both these methods used to observe the external parts of the lens are going to be appreciated in therapeutic examinations. Especially there, where it is all about defining a strict state of a capsule or yet else the internal substance of the lens, its back area and the glassy membrane. On the basis of appropriate measures of the lens' flames in the case of a living human organism, attempts to examine the shape and the relationship holding to the sight's axis seem to be dangerous, risky and of great difficulty, however, not entirely impossible as far as mathematical examination would be concerned.

The retreat of the lens from the edge of the iris may be observed only to a limited extent. That may be done on the basis of a mirror image arising there, as well as on the basis of the later and more mature image coming out of the flame when putting back and forth the candle (Fig. 4)

28. The clarity or distortion of the glassy cell on the external low part of the pupil, blurry or clear, may be best examined using the aforementioned methods which apply to the watery liquid or lens. With one exception, that being making an observation (and lighting) under the angle.

The eye cavity, where the glassy cell is placed, by mere coincidence I had the opportunity to observe using an appropriate method. Wearing glasses for the short-sighted people, I managed to examine an eye of a dog by means of the light coming upon from some distance. Why I was doing so was to learn more about the very nature of flame, which seems to radiate from dogs' and cats' eyes in an extraordinarily strong way. Thus, every time I looked at the dog's eye in a given direction, the light seemed to be rapidly striking. That was until I found

the course of the light coming from the hollowing of the glass to the internal part of the angled eye, and angled there one more time. Suddenly, the very same experiment I attempted to apply to human beings. And again, the same phenomenon did occur — the whole of the pupil appeared to be shining with a gold colour. Since I still was not sure as to the exact place in which this phenomenon of angling the light was happening, I tried to make a substitute eye, whose cavity, being full of glassy water, or even disturbed to various degrees, enabled me to spot the back side as well as the actual substance of the liquid, all thanks to the angled light.

Thus, almost none membrane or internal substance of a liquid was hidden before accurately angled light for the eye of a cautious observer. Should practitioners despising careful methods used by physiologists stop neglect this particular one at least, soon would they find it extremely useful in their everyday diagnostic work.

In the subjective view also other numerous phenomena do occur. As far as their organic conditions are concerned, I am convinced that they should be placed in the glassy cell.

Firstly. The globules and fibres are marked with parallel bordering, with bright and dark occurring alternately, different as far as to the degrees of creasing which are visible when we look through a small hole at the opposite area, bright and wide, or else peer through the lens to the eye as close as possible, at some shining object, diminished like, for example, a remote flame of a candle. Also, when the eye is in movement, like while nodding a head or putting it under some angle, they change their place and shape until they return to the resting phase. Then they with all probability are in the glassy cell.

Those phenomena are nothing else but the mirror images, which are shaped by fibres and nerves, either dead or formed as a result of some parasitic process. They may freely flow in the cells of the glassy corpus, in such a way that those of them which are more delicate — according to the optical rules — are placed closer to the retina, whereas the larger ones — respectively farther. As to make them visible, it is absolutely necessary that the rays — as much as it is only possible — radiate so that these small reflexes, especially when lightened with a weak, angled light, would not shade into nothing. That is why a device is needed to constrain and break the light. Because of that, the farther the objects are placed (these and all others, also cells, nerves and fibres which are right along the back side of the retina), the weaker light may be necessary, and the more strongly all the angled rays should be stopped. Also a smaller hole would do in such case. The distorted image is the result of this process. That is because even a small amount of light may come into the eye from one side, causing a little reflex disappear. As a result, when we look at not so shining an area, for example, a sky covered with clouds, the globules and aforementioned lines we may indeed observe.

Secondly. Also these globules which Steinbuch was the first one to observe and assign to blood, in my view, ought to be placed in the glassy cell. Even though they indeed are closer to the nerve membrane. But thanks to the tinniest — as much as only possible — cells, they still may cause their own small reflexes, if moderately lightened in the neighbouring of the back of the retina. The best time for us to observe the flow of the globules is during winter, when we star long enough at a field covered with snow or heavily-clouded winter sky.

For obtaining accurate results of the kind we just described above, the most important condition is an area lightening with a wide, weakening flame. So as to make it more easily accessible we glaze at the candlelight with a bigger lens whose focus should measure about two or three fingers at most. The distance on the other hand ought to be such that the more extended the light, the more delicate it is perceived. Then in a short time every sphere of vision with globules and fibres will be so full that the effect would appear to us as something extraordinary — how may the external objects find here their place, thanks to an undisturbed light reaching the retina.

Thirdly. Whether the edges and irises, which we often observe from appropriate distances when they surround the flames of a candle, are in fact found in the watery liquid or glassy liquid or sometimes in crystal cell is very hard to determine with absolute certainty. It is all absolutely subjective, especially that what follows is that they quickly disappear once the image of the flame becomes hidden by a finger pointing into the axis of sight. That is not the case of the moon or sun, surrounded also by edges — here, however, the reason is to be sought in atmospheric vapours.

27. The examination of the nerve membrane does not provide us with any objective data (with the exception of the aforementioned case of lightening of the glassy cell). A multitude of phenomena is then to be distinguished by subjective sensation. It seems absolutely inevitable to examine possibly the greatest number of the subjective phenomena in most distinctive individuals. However, at the same time it appears unlikely that many people are able to acutely observe those very phenomena, or to present their observations as true and reliable, thus subjecting their own organs to other, more complicated, although still not harmful, examinations, out of good will and love for science. Among phenomena that should necessarily be examined, we list the following:

a) The vulnerability of the retina should be examined, either under stronger or weaker light. That is to observe the connection between the light's intensity and the eye's ability to distinguish between objects of variable size, as well as what the upper limit of the intensity of light is for the eye so as not to blind it completely.

b) Particular individuals differ also in that respect: what are their abilities to perceive the accidentally appearing images, which are being brought into the eye after the perception of the colours from the opposite pole, which then leave a trace of themselves for a significant period of time.

c) The lighting phenomena which originate in the eye in the result of the galvanic action may be called all the more lively the lesser apparatus is used for that purpose. Thus, a more vulnerable nerves system might be offered for an examination. The most difficult burden at this point is the necessity of having a steady and specified measure of galvanism, which would be a rule for comparison of the individuals' peculiarities.

d) Phenomena caused by pressing the ball are the easiest ones. Also, they can be conducted by almost everybody, with no danger for the eye — however, the only exception being that person's attitude, if they are fearful or not confident then it is better to abandon such examination.

e) Only with great difficulty would we find a person who would never notice — even accidentally — flatters and fireballs which are normally perceived in the result of a sudden movement of the eye into its external side, especially in the morning.

f) The observation of the shape of a cell, on the other hand, does require a more careful examination as well as earlier preparation. That shape, at least in my opinion, is a central vein of the retina. That is best observed when the candlelight is being slowly brought upwards into the external pole of the sight.

g) Also, the ability of seeing straight and diagonally should be examined in different individuals, since that is, I firmly believe, a way to investigate the lesser or stronger connection between the soul and the organ of sense.

28. These and similar phenomena which could be listed ad infinitum, by no means should ever be neglected in the physiological examinations. What is of primary importance for us, who conduct those examinations is to observe what is the nature of the relationships between the eye and the brain. The eye — provided the link between it and the brain is not broken — appears to be the major organ of imagination.

The greater the energy the soul penetrates the eye with, the more careful the mind's attention it is being lightened of consciousness, the sooner and more explicitly we collect the variety of ways the eye has in its possession, and the more this sense would be elevated to the level of organ. This more subtle and reaching up to the spirit's nobility character of the eye, grabs the attention of the observers by itself when the eye's abilities, sight, its loose and purposeful movement, the right direction towards its goal, all these should be encompassed by our attention. Thus, it will be easy to differentiate the sharp, firm and well-aware objects from the blurry, faded and shaded. How incredible harmony there is between the sight and other self-directed movements of the human body we could easily observe in music, scenic and art works, not without a great admiration. Such an admirable ability should by no means be also neglected in the case of sportsmen, hunters and craftsmen of all kinds. In all these disciplines it is of great significance to establish a firm, harmonic connection between the eyes and hands. That is often (and rightly so) considered as a sign of huge abilities, talent and effort. Those equipped with greater medical experience eagerly add to the physiological factors of semiotics also the pathological ones, so as to — as there is one nature — also there was one examination of the essence of life, of the phenomena of health and illness, just like we easily distinguish the light from the dark, in the very same manner the pathological factors are to be distinguished thanks to the physiological ones — and vice versa. So explained, they would form their joyful image in the soul.

## IV. On the external physiological examination of the skin system

On the following pages I intend to provide more specific explanation of the most fundamental factors which should be taken into account during observations of the skin system of every individual.

Among the parts we should be concerned about at this point, the following may be listed: the external skin, hair and nails as well as those parts of the membrane which give mucus, which thanks to different holes communicate with the upper levels.

1. The external skin, when examined by the sense of touch, is soft or hard, moist, oily, sticky or dry, warm or cold, nimble, numb, rough or delicate, loose or tight, flexible or stiff. Those features are to be found in each individual at varying degrees. That may be subjected to the particular conditions at any given stage of life — and that is something that we should pay careful attention to since they indeed may hint at differences between various temperaments, constitutions, age, sex, and even origin and nationality. Of primary importance while

conducting this examination is our own hand, the organ of touch. If the skin is too rough, or if the movements of the hand are too fast and violent because of an uncontrolled force of muscles, or else where our attention is not yet experienced and trained enough to notice the most subtle changes, then the result is also not clear, not exact, not precise enough and we do not get the expected sense of softness or toughness, firmness or stiffness nor any other modification of cohesion.

If the sensation of cold or water has only a relative value (and that is so because the temperatures of our body and the external object differ), thus the examination should not be conducted in any other way but only using a normal, most common degree of the warmth of the touching hand. Also, the very experiment should be so conducted as we would learn how to form exact conclusions regardless of the external conditions. However high is the object's temperature and however greatly our subjective 'scales' differ, that all should be taken into account as we try to strike a balance between them. If we are to examine if the skin is dry or wet, oily or sticky, etc. it is absolutely inevitable that our own organ, a hand, would be free from them, so that the properties of the objects would not mix in our perception with those belonging to us. If the hand is wet of sweat, or sticky, or tough, it is no wonder indeed that the result we receive of the examination with respect to the properties of its subject is patently false. Wherever any doubts arise, we always can make use of changing the position of the hand or even the plate of the nail.

2. Apart from other symptoms visible on the skin, the most noticeable is the colour. First of all, one should note the variety of colours available in the human race, and then the colours resulting from mixing, from, as one may call it, hybrid origin. Here, innumerable and subject to the most subtle modifications colours can be found, which are hardly possible to count and only an experienced painter could sketch them.

Also leukopathy (vitiligo), occurring in all human races with multiple modifications, should be examined by a physiologist. It is not enough to observe what are its dominant features, but smaller deviations occurring as well in the course of the disease should also be analysed.

Possibly leukopathy could be juxtaposed — in terms of the name and substance — with melanopathy, whose transitional phases, at least in the Caucasian race, are marked as fairness (Blonde) or blackness (*Brunette*) of hair.

Such appearance of skin, which is assessed only with the eyes, is not limited to colour; it includes smoothness of the external surface and visibility of even the smallest wrinkles, pores and bulges, through which light and shadows are reflected; then transparency and external deflection of light, creating the so called local colour, which, depending on the skin structure and its condition, naturally varies, and this should not be ignored. Therefore colour varies also depending on one's sex, age, health and temperament, etc. which variations are vividly captured by painters. We can also find various and particular skin areas filled with specific colours. For instance the parts exposed to the air and light are characterised by higher moisture compared to those always covered by clothes; other parts seem more transparent at temples, the periosteum of the orbit, neck, elbows, chests, and parts with veins visible, whereas and the external surfaces of hands and lower parts of feet seem more filled with arterial blood; the outlines of papillae, the parts near the anus and genitals, which belong to the category of mucous membranes, are saturated with a darker colour; and also different states of body liquids, being bile, mucus or blood, interacting with the skin, are reflected in different colours.

3. Another factor that should not be ignored in a physiological examination is skin smell. Since there is no other sense as rich in specific sensations as smell, the conclusion is that there are countless modifications of smell for various nations and even individuals, which is proved by the sharpness of a dog's sense of smell.

And it is strange that the sense of smell is the most disregarded and neglected of all senses, in everyday life associated with shame and contempt, resulting in science closing its doors for it.

4. Equally important are special skin sensations, which are discovered in no other way but through local heautoscopy. This includes the sensation of warmness, hotness, coolness, cold, shivers, prickling sensation, pressure, numbness, itching, heightened or lowered sensitivity, various types of stabbing, oppressive, pinching, etc. pain which spreads through the entire skin or its parts — this all, perceived by the inner sense, should be clearly communicated, using appropriate terms and categories.

5. Now, moving from the common specifics of the skin, I shall discuss its organic structure. The first that should be mentioned is epidermis. It shows pores and nodules, pressed in various ways hollows, wrinkles and larger furrows.

Whether pores are actually in epidermis is still debated among scholars, but as far as I am concerned, epidermis is perforated with pores, but due to their flexibility,

they are closed to the point that they are there only in case of sweated skin, when liquid pours out of it, but they are not visible to the eye. A similar phenomenon can be easily compared if one takes a cut out of an extensible rubber film and pierces it with a needle — then although the two holes will be visible on the surface, the canal — even if cut out into smallest blades — cannot be possibly discerned. The same goes with the epidermis, that is only the holes at the external surface are visible, but the fact they are connected with the leading liquid canal is shown by sweat, blood flow, or even its spontaneous outflow. And the most prominent holes can be seen in the bands and curves of holes appearing in great quantity on the surface of soles and palms, where sweat drops are visible even with the naked eye. As for them, it should be noted that in more advanced age many of them are closed, which is reflected and explained by weakening of the skin functions. The size of sweat cavities differs between various body parts. On cheeks and on forehead they are quite large, reaching almost to mucous and sebaceous plugs, and at the eye sockets they usually form papillae, they can be found at the base of hair in spreading folds, from which they grow. Their direction is usually perpendicular, with the exception of the base of fingernails, where it can be seen how they slant towards the tip of the fingers. Nowhere is the internal structure more thick than in papillae, which constitute collection of parallel and compact canals carrying lymph or blood (Fig. 21).

Besides, I believe that epidermis, as far as its structure is concerned, belongs to hydrophane and pyrophane, which is why it is constantly saturated either with atmospheric vapours or with blood outflows, through which skin transpiration and resorption with external factors occurs. And there are few people who would doubt that feature of epidermis, since it can be seen on one's body — sometimes swollen with liquid and somehow softened, other times dry and dehydrated.

Wrinkles in different parts of the skin differ in appearance. Their size and direction highly differs and depends on the direction body parts bend. Some of them depend on the base of hair, where they form a kind of a centre, and its movement is triggered for example by the feeling of fear. But let anatomy describe the forms and modifications of such folds on the entire surface of skin.

On small areas situated between wrinkles there are tiny nodules, which in fact are outlines and craters of small pores. Allow me to elaborate on larger furrows present on palms. They are worth pondering on, as recently they have become the object of study for the pseudoscience of chiromancy. There is no doubt that they are determined by various types of movement, for which hands and fingers are shaped, therefore there are many different terms describing them. That is why I distinguish opposing, outgoing, incoming, stretching and bending lines. The following should be mentioned in particular: 1) The line opposite to the thumb (Fig. 5 letter a) (by chiromants called the life-line), which surrounds the convencity of the smaller muscles of the thumb. 2) Behind it there is an almost parallel line reaching the thumb (letter b) (the Mars line) 3) a line stretching from the little finger, at the bottom of which, at the outside edge of the hand (letter c) the line can be seen (the wedding line as called by chiromants). 4) The line closing three elbow fingers (letter d) (the table line), which when pointing with the index finger, through bending the other fingers results in a fold, which is why I would call it indicative line. 5) The closed palm line (letter e) (the natural line) which is almost parallel to the indicative line, crossing the middle part of the palm in the opposite direction. 6) Bending line of the ring finger and the middle finger (letter f) (Venus line) which in some individuals encircles the base of those fingers. 7) The bending line at the wrist (letter g) (Rascet line) 8) Lines opposite to three elbow fingers (letter h), which are less visible than the others and run almost parallel with the line opposite to the thumb, from the wrist to the base of the index finger and the middle finger (called by chiromants the fame line and fortune lines). 9) Finally the stretching line which is visible in finger joints — if they are strained — more markedly and from a greater distance. There are some analogies to those lines also in the sole, although its movability, due to its functions, is found more limited. Even if I did not object that those lines have some physiognomic sense, since hands are the main instrument of people's work and various types of movement they are adapted to reflect the internal properties of the individual, and hence one can assume that they are a consequence of life events — nevertheless I am convinced that there is little truth in chiromants' claims, and I think that the effects of their work are comparable to those of augurs and haruspices whose divination techniques involved interpreting bird flights and internal organs.

Our attention is drawn to the extraordinary placement and bends of the hollows adjoining in the inside of hands and feet, especially in the farthest finger-joints. In general, though they are always mentioned in physiology or anatomy compendiums, yet when it comes to such an essential organ as human hand, which beside its movement function also serves as the instrument of the sense of touch, none examination is too small to bring positive effects in further study of that organ. After countless observations, I have discovered nine main types of bends, where the hollows with touch functions are placed in the inside part of the farthest finger-joint.

I shall describe them briefly, and the rest can be seen on the attached figures:

1) Transversal bends (FIG. 7). Beginning from the joint fold from one cheek side to the other, hollows run in almost a straight line, first transversally, then in the centre they curve a little, and then they bend with the circle of the joint-finger in concentric arches.

2) The elongated central stria (FIG. 3). Almost shaped the same as previously, the only difference being that transversal bends close, as if a core, the small stria towards transversal hollows.

3) The diagonal stria (Fig. 9). Within the area of transversal bend (I) from one or the other side a single line, running almost to the centre of the cheek, stops.

4) Diagonal sinus. If that diagonal line return with an ordinary bend to the side from which it originated returns and is followed by many others with similar bending, a diagonal sinus is formed, more or less straight or sloping, at the base of which it forms, from one side or the other, a triangle of crossing lines. Such arrangement of hollows where a diagonal sinus is situated is common and one can say it has become the specific feature for the human race, as apes usually have highly concentrated elongated hollows (Fig. 19). The top of the diagonal sinus in general bends toward the radiated edge; however it should be noted that in case of the index finger the opposite phenomenon occurs most frequently, so that the top is directed towards the elbow part. In toes this is the only form that is encountered. Frequently also the ring finger, while in other fingers diagonal sinuses or other forms are simpler, is characterised by a more complex form.

5) Tonsil (Fig. 11), where the diagonal sinus described above runs back, returning to the centre of its tonsil sinus, blunted at the top and nodular at the base, equipped with concentric hollows.

6) Spiral (Fig. 12). Imagine transversal bends, described in (I), from straight to curved lines, not gradually but with higher variation, which form in semicircular space reaching with straight lines as if to the surface. This space is filled with a spiral line — simple or complex — winding towards itself. The spiral is simple in the geometric sense, I shall call it complex when from the centre from this point or in intervals multiple forked lines run and curl. From both sides where the spiral adjoins the ramification of straight and bent lines that surround it two triangles are forms, such diagonal sinus appears only from one side.

7) Ellipse, elliptic trumpet (Fig. 13). The same, aforementioned semicircular sinus is filled with concentric ellipses which surround a short, straight line in the centre.

8) Circle, round trumpet (Fig. 14). Similarly to the line, now an ordinary nodule occupies the centre and is surrounded with concentric circles until it touches the wrinkles of the semicircular sinus.

9) Double top (Fig. 15). When part of transverse lines runs in curves and bends in one and half, and another line from the other side encircles it similarly, two tops joined with each other are formed. Such shape is encountered only in the thumb, index finger and ring finger. The tops of curved sinuses bend in various directions, moving toward an elongated shape, or slope diagonally or even run crosswise.

In all forms described in par. 6, 7, 8 and 9 triangles are visible where transverse lines reach out from both sides from curved lines. In all the other finger-joints transverse lines are placed from one angle to the other, running straight or curving a little.

A few things should also be said about the paths and bends of the hollows in the palm. Near the deflection of the wrist a simple junction of three lines, forming a triangle is visible — from the bottom separated with lines transverse to the wrist, while at both sides with multiple hollows reaching as far as the thumb ridge (Wallen) and the ear finger.

From the area between the index finger and the thumb there is a multitude of parallel lines, which in the centre of the palm run in different directions along the palm shaping line, towards the metacarpus of the little finger and the thumb, reaching as far as the top of the triangle close to the wrist. This is their most common arrangement. The lines running from the area between the index finger and the thumb to the outside edge of the metacarpus are joined by other lines parallel to the base of the fingers, the spaces between them are filled alternately with sinuses and tops, but describing them here would take too long. In the ridge of the thumb there can be small trapezoid surface, where the surrounding hollows are arranged crosswise. In the ridge of the ear finger at the base of the edge of the metacarpus one can often observe a larger sinus, where hollows running from the edge bend towards it, and sometimes an elliptic trumpet in the swelling of the ear ridge is visible.

Similar lines can be found in apes' palms, and even in their prehensile tail. Distinguishing them may help in identifying specific traits, which — if their significance is great enough — may be determined in the future by zoologists. (Fig. 19, 20)

I shall elaborate on the physiological functions of those hollows on another, more appropriate occasion.

6. With respect to the origin, hair and fingernails are most similar to epidermis.

The density, length, thickness, bending and direction of growth, shape, structure, colour, transparency,

hardness or softness which resists pressure or submits to it easily, electricity, hygroscopic quality, and even — if possible — the chemical composition should be examined in various individuals. Apart from these physical organic properties, organic vegetative properties should be analysed as well, including the fastness of growth or numbness, distribution in different body parts, time and reasons of hair sprouting and falling, grey hair and other colour modifications.

Here I shall include some observations on various directions of fluff arranged in many ways through sutures, tops and ramifications as noticed in a six-month old boy.

First of all sutures situated in the central line of the body should be distinguished — the front one and the back one, then two on the sides, and palm-shaped lines, where the hairline bends in different ways, separation, tops, and parting into four directions where hair is parted into four areas, joining and separating in crossing directions. (Fig. 16, 17, 18).

First of all the front middle suture should be mentioned. In the structure of the breastbone it contains ramification from which hair in the middle line growing on the nape of the neck and navel run; running to the navel, on the border they are mixed, continuing the line in the opposite direction which again parts in the lower bottom into four directions, where in the upper angle the hair is bent, similarly to the breastbone ramification, upwards, and in the lower angle — downwards, almost disappearing in the mons Venus. Another ramification is visible in the nape between the hyoid bone and larynx, and its lower angle is formed with hair from the breastbone ramification stretching in the middle line upwards and to sides of the nape of the neck; similarly hair running from the chin in the upper line head toward sides. In the nose, which lacks hair, the central place of the larger irregular ramification is said to be situated, whose upper angle from the base of the nose is heightened with hair heading upwards, to the temple, the lower angle is elongated from the nasal septum through upper and lower lips, reaching the chin and finally the nape ramification. The temple also features a ramification, whose lower angle is formed with hair from the base of the nose growing upwards, which separate into two sides, forming eyebrows, and the upper angle — with hair heading downwards. There is a top the hair forming which runs in curves from the centre to the front, back and sides, but in such a manner that from the left side (in other individuals in different parts) are separated in the shape of palm, and at the back of the head they form a kind of small fringe (Fig. 17), from which it is elongated in a wide and almost double line in the back, with hair parallel to the coccyx, where again, in the a little protruding '*coccendice*' they concentrate forming a kind of a tail, which in infants appears a shape akin to a horn. In the anus hair partly heads towards the side of 'coccendicis' and partly to the genitals, where one can see how the doubled ramification is formed together with the hair growing from the mons Venus in the anus and genitals.

It is therefore necessary to differentiate multiple ramifications, where the hair converges or diverges from the midline. The part that converges is located on the forehead, nape of the neck, navel, genitals and coccyx. There one can notice ramifications alternated with partings separating on the top of the head, in the nose, on the breastbone, abdomen and anus. Each of the two types of ramifications is therefore encountered five times.

One must also pay attention to two side sutures running from the fifth rib (where it is almost connected with its cartilage), and ending in the front part of the pectineus muscle of the ileum bone.

In the area of the fifth rib, where they start, there is the converging ramification, where the upper angle turns into a line diverging so as to form the shape of a palm, which runs through the front fold of the armpit, closes towards the ramification and emerges in the area of the vaccination mark on the shoulder. The other end of the side suture is located in the front corner of the pectineus muscle of the ileum bone in the diverging ramification, with prolonged lower angle near the diverging line, taking the shape of a thigh palm. Side sutures, which are separated by the converging upper ramification and diverging lower ramification, run into sutures with the shape of a palm of a shoulder and thigh.

The shoulder ramification diverges from the hair of the upper and lower angle; the side angles are formed by the converging from both sides of palm lines, which start from the armpit. Therefore, the hair on the armpit, although very sparse (quite differently compared to adults), can be considered as a common centre for two palm lines, where the front line is extended with the triple orientation to the higher side ramification, to the sternum and to the arm. The back line bends towards the shoulder, where the back side angle of the ramification is formed. The other directions of the hair diverge into internal part of the shoulder, the side of the trunk, on the back and the chest. (Fig. 18)

In the outer part of the shoulder, hair grows towards elbow, and similarly in the inner part, towards the elbow bend. In the front part of the forearm, hair growing towards the hand diverges into both sides, in such a manner that on the radial edge it diverges in almost transverse arches, whose convexity heads towards the hand — in the outer area of the elbow it runs in the opposite direction so that, where the hands are pulling backwards

towards the tip of the elbow, opposite to the arm hair, it forms a bundle. On the elbow edge of the forearm, where hair suddenly merges in different directions, a bristling separated line is formed in the bundle of the tip of the elbow. On the outer surface of the arm, hair runs from the radial edge to the elbow edge in transverse direction.

The ramification where the side sutures near the pectineus muscle of the bone are separated, with its lower angle going into the palm line, which is conducted with the angle bend to the third part of the outer edge of the thigh, where hair is divided into opposing directions, part of which runs through the leg and part on the rear surface of the back thigh runs toward buttocks. Moreover, in the front part of the thigh hair falls down and on the inner and outer side it bends across, whereas in the rear part — as already mentioned — it bends from the knee pit to the buttocks. Everything goes downwards on crossbones.

Hair in the back of the outer ear part, starting from the lobe, to its top (which is a little pointed as in animals), goes up (just as in the outer part), in such a way that it forms a bundle while diverging in the lobe; on the inner part of the lobe, which is directed towards the skull, hair parts towards the periphery. In the lower, the transverse part of the helix, where the lower muscle of the helix is placed, hair leans towards the inner part of the ear. I discovered the inner surface of the piece of the ear, which adults have planted with hair, to be completely bald.

The arrangement of hair on the torso between the sutures can be easily described if we focus our imagination on directing it through ramifications and palm lines to the sides. Its arrangement on the sides of the nape of the neck is the most uncertain, however, I believe that there should be at least one, yet invisible, suture.

On the basis of what has already been said, it should be noted that human infants have numerous features that show a certain analogy to those of animals; such as a hair bundle in the ear lobe and in 'coccendice', here we can enumerate hair converging in opposite directions in the outer side of the tip of the elbow joint of the arm and forearm, which elsewhere is a specific feature of the orang-utan and the gorilla.

Moreover, there is such a similarity between the direction of hair and hollows serving touch functions, and their winding, palm and triangular forms, etc., that it easily comes to mind that nature is the same everywhere and epidermis is formed from the same matter, which allows the growth of hair, and which forms the above mentioned hollows. The hollows seem to be formed due to coalescence of hair and its containment and accumulation in the skin.

It would be worth describing findings on the growth of hair and nails among different individuals, as it can help set appropriate measures with almost mathematical precision. We should also pay attention to various forms of nails in various individuals, their own dimensions and dimensions in relation to the hand and the rest of the body, the colour and pigmentation, size and shape of helix, no less than other things so far considered.

Generally, it is possible to observe and conduct experiments of the vegetation system of the epidermis, if it is stimulated either by pulling or pressing impact, or the impact of chemical substances. Numerous modifications take different forms of skin diseases, cachexia, eczema, rashes, which all make their contribution to the principles of physiological vegetation.

7. The Malpighi grid is not that easily available to the external study of a living organism, unless someone had a gelatinous substance for this purpose which, pulled out from a pimpled or burned skin, is then visible.

At this point I must include a few comments on elastic strands, with an average diameter of sheep's fleece, which — when the skin is expanded from softening, from the inner surface of the hand or foot is lifted slowly, is pulled at an angle, which is formed by the bare skin and the inner surface of the skin — are spread in almost equal distances and are easily visible through constant pulling separated by elastic movement. I believe — although it is possible that I may not be right — these strands sprouting from the centre of touching papillae, which converge according to the order, come to an end in small pores, which at equal distances settle epidermal hollows. It is difficult to determine whether they are vessels or actual strands, or rather separating canals. It was a lucky coincidence that the same, dried strands could be observed. When examining the similarity of how caffeine brew and timber acid work, I left a human thumb soaked in infusion to dry and when, due to its lower shrinkage, the epidermis was pulled and came off the dermis, the strands on both sides appeared as either whole or partly torn.

In the papillae, when as a result of softening, their structure becomes more visible, the strands can be distinguished — the ones which follow from the outer surface of the skin, and which after pulling the epidermis together with the papilla — are visible in the shape of a brush, and the papilla remaining in the epidermis looks as if punctured with small holes.

Many times I have seen on my own hand that when a papilla becomes infected, it is just a cluster of coils, which can be separated from each other with a perpendicular cut-off, and where the transparent sides of the

blood vessel running toward the outer end are visible, or which, after the horizontal cut, secrete lymph or blood through small holes at equal distances.

8. The network of capillaries extending under the entire surface of the epidermis can be seen in a living organism even through external examination. Take a lens with a focal length of almost half of the thumb, attach it to the apparatus used by canvas merchants to calculate the strand on the surface areas where in the focal distance the plate pierced with a square hole should be attached and fixed to the horizontal analysis of the subject. With this apparatus, the reddened skin or torn skin, or as a result of enlargement, in the light of the sun — when the skin is additionally moistened with oil, which makes it more transparent — may be investigated. It is then possible to observe any vascular network especially on sensitive subjects, and also the roots, pointing upward to the epidermis and separated with a red point.

This will enable easy observation of modifications in the distribution and branching of vessels through the entire surface of the skin. It will also, to a certain extent, facilitate external examination of the vascular system. Such examination is also suitable for observing any conditions, lichens, skin lesions, various forms of inflammation and ulcers.

9. The close relationship of the skin and the muscle and fibre system can be presumed on the basis of furrows and hollows, which are visible in the fleshy and thin fibres as well as muscles between bands of tendons and which are formed by the fibrous junction between the skin and aponeuroses.

Such connection is most visible on the surface of the feet, where the plantar aponeurosis with dermis substrate is most closely connected with strong fibrous plaques and interspersed with fat. The same ligament is visible in the aponeuroses and fasciae latae of the high, where elongated plaques are attached extending through the fat of the dermis, which is especially visible in the gluteus maximus, where individual bundles are interspersed with fibrous extensions; and especially in the greater trochanter, where gluteal muscles are located, such fibrous connection with the skin is visible. A hollow is also seen in the fat muscles of the outer surface, where — if one imagines fingers gripping the skin — is easily pulled back by the tension of gluteal muscles tense and tensioner fascia lata. On the white line of the body, and in the abdomen, where the rectus muscle is tangled with transverse sutures, also fibrous straps are prolonged towards the dermis. In the hand, aponeuroses and tendons in the wrist and metacarpus closely adhere to the skin. Such juncture is easily visible also in the tip of the elbow and on the shoulder as the muscles work. The reaction is more rapid where the skin adheres to the bone. The same ligament between the muscles and the skin forms furrows and wrinkles on the face. Their angles of inclination from the muscle fibres under the skin take the form close to a triangle.

Such examination of the relationship of the skin to the fibres and the muscle system, a little more thorough, has great importance in the anatomy studied by sculptors and painters, where neither empirical imitation of a naked body, nor sketching of skinless muscles is not enough where it comes to accurate and subtle depiction of the smallest surface elevations and depressions on the body of an organic nature.

10. The examination of the fatty layer under the skin should not be underestimated on the basis of the above mentioned argument, since the outer layer and the shape of the body are the most determined. The separation and the amount of fat is visible on the first sight, and is examined through fingers in activities of the hand. Certainly different individuals have a different texture, colour, and the accumulation of fat. Let it be noted by the way that the two buttocks in a human contain heaps bit hard fat, interspersed with abundant and strong tissue fibres which recall to mind a certain analogy with the thick-skinned buttocks of apes.

11. Finally, the mucosa should be examined. It is possible owing to the holes which allow it to be accessible. It is necessary here to differentiate the soft palate and tonsils, and especially tongue papillae, which will allow the appropriate material for all the knowledge of the human being to be delivered and which is in practice equally important as the knowledge of species.

**Theses to be defended**

1. The notion of organic constitution has not yet been precisely defined.
2. Spontaneous reproduction is a fact.
3. Autarchy of nature is the most important countermeasure of the medical arts.
4. Too strict separation of surgery from medicine is harmful.
5. General pathology should be closely connected with the physiological science.
6. Scientific medical practice should be strictly distinguished from the practice pertaining to the everyday life.

**Lithography**

Fig. 1. Reflection of the candle flames from the anterior and posterior corneal; immediately reflected from the anterior and posterior surface of the lens.

Fig. 2. Reflection of the flame from the front of the cornea and the posterior lens surface, where the inverted image is turned round.

Fig. 3. Reflection of the flame from the front of the cornea and the front of the lens, where a straight image is shown.

Fig. 4. Small semicircular shade falling from the iris to the front surface of the lens.

Fig. 5. Lighting cone from the white matter, reflecting the focus of the front chamber.

Fig. 6. Furrows on the palm, corresponding the its joints and bends.

Fig. 7–15. Nine main types of hollows with touch functions, situated opposite to the finger-joints at the edge of the human hand.

Fig. 16. Separation of fluff in an infant, in the shape of ramification in the middle line of the body.

Fig. 17. Separation of hair at the vertex of the head.

Fig. 18. Fluff suture which diverges towards the side ramification on the breastplate.

Fig. 19. Arrangement of the hollows with touch functions found in the hand of a Barbary macaque.

Fig. 20. Hollows in the lower part of a spider monkey's tail.

Fig. 21. Structure of a papilla, visible through division in the shape of a cross and horizontally, observed through magnifying glass.

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